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Preface

This report contains findings from a project conducted by the Project HOPE Center for Health Affairs under contract #DCT-98-5194 to the Maryland Health Care Commission (formerly the Maryland Health Care Access and Cost Commission). The purpose of this project was to identify an approach that could be used to profile the quality of care rendered to Maryland residents with chronic conditions. Although the analyses included in this report are limited to Medicare beneficiaries with diabetes, the quality profiling strategy may – with the availability of appropriate data – be extrapolated to other populations or conditions and serve as the basis for a more extensive state-level quality monitoring system.

The findings and recommendations detailed in this report are those of the Project HOPE Center for Health Affairs and do not necessarily reflect the views of the Maryland Health Care Commission. The work described in this report has been monitored by MHCC staff monitored the work completed under this task order to ensure compliance with the contract's technical specifications. Comments about this report may be sent to Ben Steffen at the Maryland Health Care Commission, 4201 Patterson Avenue, Baltimore MD 21215 or via e-mail at bsteffen@mhcc.state.md.us.

Report Highlights

Objectives

This project is designed to achieve three objectives. First, it uses information on the number of Medicare beneficiaries over the age of 65 who received diabetes care to estimate prevalence of diabetes in this population. Second, it estimates the proportion of Maryland Medicare beneficiaries with diabetes in 1997 who received clinical preventive services known to reduce the risk of diabetic complications – a hemoglobin A1c (HbA1c) test and an eye exam for diabetic retinopathy. Third, it identifies patient and provider characteristics associated with a greater likelihood of receiving these clinical preventive services.

Analytic Approach

Patient-level claims from the 1997 Maryland Medical Care Database (MCDB) and the 1997 Medicare Outpatient Standard Analytical File (SAF) were used to estimate receipt of diabetes care and use of clinical services. Medicare beneficiaries receiving diabetes care were identified from these databases using diagnosis and procedure codes. Patients were determined to have received an HbA1c test or a diabetic eye exam during 1997 if at least one claim with a CPT-4 code corresponding to these services was reported in either the MCDB or the SAF database. Multiple regression analyses were conducted to identify characteristics of Medicare beneficiaries associated with receipt of these recommended clinical preventive services.

Key Findings

Beneficiaries who Received Care

- An estimated 14.1 percent of elderly Maryland Medicare beneficiaries with diabetes received outpatient care in 1997.
- The prevalence of diabetes in this population was estimated to be the same among women and men, approximately 14.1 percent.

- Estimates of diabetes prevalence varied by county with a low of 9.8 percent in Talbot County and a high of 17.1 percent in Charles County.
- Diabetes prevalence rates were highest among Medicare beneficiaries between the ages of 75 and 84 (15.4 percent) and lowest for beneficiaries 85 and over (10.9 percent).

Rates of Receipt of Diabetes Clinical Preventive Services

- Among Medicare beneficiaries with diabetes, 59.3 percent received an HbA1c test and 44.4 percent received an eye exam in 1997.
- Rates of receipt of HbA1c were highest in Garrett, Howard, Montgomery, and Queen Anne's Counties, mainly non-contiguous counties. Rates were lowest in Calvert, Kent, Somerset, and Worcester Counties.
- Rates of receipt of eye exams were highest in Harford, Montgomery, Wicomico, and Worcester Counties. Charles, Garrett, Howard, and Washington Counties had the lowest rate of receipt of diabetic eye exams. Interestingly, Garrett County had the highest use of HbA1c and among the lowest use of eye exams.
- Beneficiaries cared for by endocrinologists had the highest rate of HbA1c use, 82.6 percent, and eye exam use, 61.2 percent. Rates of preventive services were consistently higher when multiple types of physicians treated beneficiaries.

Factors Associated with Receipt of Preventive Services

- Men and women were equally likely to have received both HbA1c testing and an eye exam.
- Medicare beneficiaries between the ages of 65 and 74 were the most likely and those 85 and over were the least likely to have received an HbA1c test.
- Receipt of eye exams differed by age, with Medicare beneficiaries between the ages of 65 and 84 being the most likely and those over the age of 85 being the least likely to have received an eye exam for diabetic retinopathy.
- Across primary care specialties, the likelihood of receiving an HbA1c was greatest among patients visiting an internal medicine physician, followed by those with visits

to a family practitioner. Among specialists, patients who visited an endocrinologist at least once had the greatest likelihood of receiving an HbA1c exam.

- Patients who made one or more visits to either an endocrinologist or an ophthalmologist were the most likely to have received an eye exam

Conclusions

The estimated rates for 1997 suggest substantial improvement in utilization of HbA1c from an earlier study[a] which found that in 1990/1991 only 22 percent of elderly Medicare beneficiaries in Maryland had received this test. The 1997 rates of utilization of eye exams, however, indicate a slight decline from the 1990/1991 Maryland rate of 49 percent estimated, which was estimated in the same study.

The factors that account for the differences in utilization of the diabetes clinical preventive services examined are difficult to identify, but appear to be related to both patient and provider characteristics. The most important patient characteristics included age and county of residence. It was not possible to determine why rates of utilization of clinical preventive services varied by nearly 50 percent across counties. The physician-to-population ratio in each county had no bearing on receipt of HbA1c or eye exams.

The specialty and mix of physician specialties treating patients with diabetes appears to have a significant relationship to whether or not clinical preventive services were rendered. Utilization of both HbA1c and eye exams was higher among patients treated by both primary and specialists physicians, than for patients who were exclusively treated by either primary or specialty physicians. Of particular importance, patients that incorporate an endocrinologist into their diabetes treatment dramatically improve their likelihood of receiving either of these two key clinical preventive services.

[a] Weiner JP, Parente ST, Garnick DW, Fowles J, Lawthers AG, Palmer RH. Variation in Office-Based Quality: A Claims-based Profiled of Care Provided to Medicare Patients with Diabetes. *JAMA* 273(19):1503-1508, 1995.

Recommendations

- The Maryland Health Care Commission should examine whether it is feasible to include selected diabetes outcome measures in their diabetes quality of care profiling system;

- In collaboration with county public health departments and state medical associations, the Maryland Health Care Commission should (1) explore the factors that account for county-level variation in utilization of HbA1c and eye exams, and (2) develop effective strategies to educate Maryland seniors with diabetes on the importance of working with their physicians to obtain appropriate diabetes care; and

- The Maryland Health Care Commission should work with state medical associations, county public health offices, and local or regional health systems to facilitate development of appropriate and innovative interdisciplinary team approaches for treating elderly patients with diabetes.

Section I: Overview of Diabetes

Causes and Prevalence

Diabetes mellitus is a disorder of carbohydrate metabolism in which the body does not produce or properly use insulin, a hormone that is needed to convert sugar, starches, and other food into energy needed for daily life. In Type 1, insulin-dependent diabetes, the immune system attacks and destroys the insulin-producing cells in the pancreas, resulting in little or no production of insulin. In Type 2, non insulin-dependent diabetes, the body does not use insulin effectively. Both types result in an unhealthy buildup of glucose in the blood and an inability of the body to efficiently use energy.[1]

Nearly 16 million people or 6 percent of the United States population have diabetes – approximately half are unaware of its presence. In Maryland, approximately 300,000 residents are estimated to have diabetes.[2] Diabetes is more prevalent among persons over 65 years of age; 18.4 percent of all people in this age group have diabetes compared to 8.2 percent of persons age 20 or older.[1] Among the population with diabetes, 90 and 95 percent have Type 2 diabetes. Type 1 diabetes occurs equally between the sexes, but is more common in whites than in nonwhites. Type 2 diabetes is more common in older adults, especially among those who are overweight. It occurs most often among African Americans, Hispanics, and American Indians.[1]

Diabetes and Associated Complications

Diabetes is the seventh leading cause of death and a major cause of disability in the United States. Each year over 190,000 Americans die from diabetes.[1] Many other individuals with diabetes develop one or more potentially life threatening conditions – including blindness, kidney disease, nerve disease, heart disease and stroke – that can result in decreased physical functioning, disability, and reduced quality of life. An estimated 60 to 65 percent of people with diabetes have high blood pressure, and 60 to 70 percent have mild to severe forms of nervous system damage, such as impaired sensation, pain in the hands or feet, or slowed digestion. The risk of death from heart disease and

stroke among people with diabetes is 2 to 4 times greater than the risk for people without diabetes. Diabetes is the leading cause of blindness among persons aged 20 to 74 years, as well as the leading cause of end-stage renal disease and non-traumatic lower limb amputations.[3]

Cost of Diabetes

Diabetes is one of the most costly conditions in the United States, representing 5.8 percent of total personal health care expenditures in the U.S.[3] The national cost of diabetes care was estimated to be $98 billion in 1997. Of this amount, $44 billion was attributable to direct medical and treatment costs; the remaining $54 billion was attributable to indirect costs, such as lost productivity resulting from disability and premature death.[3] Medical expenditures in 1997 for people with diabetes averaged $10,000 compared to nearly $2,700 for those without diabetes.[5]

Prevention of Diabetes Complications

Although there is presently no cure, diabetes may be managed with insulin or other medications, appropriate diet, and exercise. Many life-threatening or disabling secondary conditions that can result from diabetes may also be averted or moderated with appropriate preventive care. The Diabetes Control and Complications Trial, a 10-year study of persons with Type 1 diabetes, for example, found that maintaining blood glucose levels close to that of non-diabetics reduced the risk of developing major complications.[6] The risk of foot ulcers and lower limb amputation may be reduced through routine physicals that include a foot exam to detect the presence of neuropathy or vascular complications.[5,7]

Two clinical procedures that are also recognized to reduce the risk of diabetes complications include screening for diabetic retinopathy and monitoring of glycosylated hemoglobin levels or hemoglobin A1c (HbA1c). Retinopathy screening consists of an eye exam to detect changes in the retina that may signal the impending loss of vision.[8]

HbA1c blood tests are used to determine whether glucose levels are within an appropriate range. Development of diabetic complications has been linked to HbA1c levels in the blood and monitoring of patients' glycemic control with HbA1c tests is recommended to reduce the risk of these complications.[3,5,9]

Diabetes Quality of Care Measures

Strong scientific evidence suggests retinopathy screening and HbA1c testing reduces the risk of blindness, neuropathy, or other complications of diabetes. As a result, several leading consumer, provider, and government organizations include retinopathy screening and HbA1c testing in their treatment guidelines or quality monitoring efforts. Although specific standards of care may differ somewhat across organizations, the American Diabetes Association (1999), the American Association of Clinical Endocrinologists (1999), and the Center for Disease Control and Prevention (1991) currently recommend screening for diabetic retinopathy and HbA1c for patients with diabetes.[3,5,7]

While the receipt of these procedures does not indicate that an individual will not develop diabetes-related complications, the extent to which these services are rendered is an important indication of the quality of care rendered to people with diabetes. The National Committee for Quality Assurance (NCQA), a private, not-for-profit organization that accredits managed care organizations, requires health plans to report the proportion of diabetic patients in the plan who had at least one eye exam during a two-year period as part of the Health Plan Employer Data and Information Set (HEDIS). In 2000, NCQA will also incorporate into HEDIS testing for HbA1c as one of six measures included in a broader category termed "Comprehensive Diabetes Care."[10]

The Health Care Financing Administration (HCFA) will require Medicare managed care plans to report data on each of the six measures that comprise the HEDIS Comprehensive Diabetes Care measurement set beginning in the year 2000.[11] Similarly,

the Maryland Health Care Commission will require health plans to report data on these diabetes measures in their year 2000 performance reports.

Section II: Method for Determining Receipt of Diabetes Care and Calculating Diabetes Quality Measures

This report is designed to achieve three objectives. First, it uses information on the number of Maryland Medicare beneficiaries over the age of 65 who received diabetes care to estimate diabetes prevalence in this population, by demographic characteristics and county of residence. Second, it estimates the proportion of Maryland Medicare beneficiaries with diabetes in 1997 who received clinical preventive services known to reduce the risk of diabetic complications – a hemoglobin A1c (HbA1c) test and an eye exam for diabetic retinopathy. Third, it identifies patient and provider characteristics associated with a greater likelihood of receiving these clinical preventive services.

Identifying Medicare Beneficiaries who Received Outpatient Diabetes Care

The population of Maryland non-institutionalized Medicare beneficiaries over age 65 who received care for Type 1 or Type 2 diabetes were identified from the 1997 Maryland Medical Care Database (MCDB) and the 1997 Medicare Outpatient Standard Analytical File (SAF). The MCDB is an all-payer physician claims database originally collected by the Maryland Health Care Commission to conduct relevant health policy analyses. Encounter information on nearly 90 percent of all physician and supplier claims in Maryland are reported in the MCDB. Data elements contained in the MCDB include the provider of service, patient demographic information (e.g., age, sex, county of residence), procedure codes (CPT-4) performed during the encounter, and diagnoses codes (ICD9-CM).

Data from the MCDB were linked to data from the Medicare Outpatient SAF, using patient identification numbers[b], to ensure that individuals who received clinical preventive services in hospital outpatient departments or other outpatient institutional

[b] For confidentiality reasons the MCDB and the SAF encrypt patient identification numbers. The encryption algorithm used for the MCDB was applied to the SAF in order to be able to link records across files. Linkage in this manner permitted the protection of patients' privacy since only encrypted beneficiary health insurance claim numbers were used.

settings were also identified. The Medicare Outpatient SAF is a claims file compiled by HCFA that contains records for all Part B services provided to Medicare beneficiaries by outpatient institutional providers. Data reported in the SAF parallels that contained in the MCDB.

To ensure that the coded diagnosis was based on clinicians' judgement of the patients' condition and to enhance the validity of the analysis, only those encounters with an evaluation and management (E & M) CPT-4 code (99200 – 99499) were retained. These criteria excluded records performed outside physicians' offices (many of which corresponded to radiological, laboratory and certain diagnostic services) from the patient selection process and reduced the likelihood that diagnostic codes were assigned by clerical or technical personnel with limited knowledge of the patients' condition. Claims records for each beneficiary were reviewed to identify individuals with at least one physician encounter with an associated ICD9-CM code between 250 – 250.9, Type 1 or Type 2 diabetes.

Assuming that all elderly Medicare beneficiaries with diabetes received outpatient care, these approximate the prevalence of diabetes in this population. Analyses from the 1996 Medicare Current Beneficiary Survey indicate that approximately 13 percent of Medicare beneficiaries did not use at least one physician service in 1996.[12] We believe that the number of patients with diabetes without a physician contact, however, is significantly less, and rates of receipt of diabetes care were used to estimate prevalence.

Determining Receipt of Recommended Monitoring Services

The percentage of Medicare beneficiaries in Maryland with diabetes who were screened for diabetic retinopathy and who received testing of HbA1c levels in calendar year 1997 was estimated for the state, counties, and selected beneficiary characteristics, by examining all available claims records for each patient.

Receipt of a diabetic retinopathy screening test was concluded if at least one encounter was associated with one of the following CPT codes: 92002 – 92019, 92225 – 92260. Receipt of a laboratory test for hemoglobin A1c was concluded when patients had at least one claim with a CPT-4 code of 83036.

Since rates of receipt of preventive services were calculated from encounter records, the actual rates of use of HbA1c and eye exams for elderly Medicare beneficiaries with diabetes may be lower than reported in this study if a large number of beneficiaries with diabetes had no physician contact in 1997.

Determining Beneficiaries' Diabetes Care Provider(s)

An analysis was conducted to determine the types of providers that treat elderly Medicare beneficiaries with diabetes. Claims records for Medicare beneficiaries in the state with an associated E & M CPT code and for which a diabetes ICD-9 code was reported were identified. Provider specialty codes were examined to determine whether each patient sought care exclusively from primary care physicians, specialty physicians, or from a combination of both. Physicians were designated a "primary care provider" if their specialty code designation was general practice, family medicine, or internal medicine. All other specialty designations were coded as "specialty care provider".

The proportion of elderly Medicare beneficiaries with diabetes who exclusively utilized primary or specialty physicians was calculated and compared to the proportion of Medicare beneficiaries in the state who received care from both primary and specialty care providers. Rates of receipt of clinical preventive services were estimated for patients treated by primary or specialty physicians exclusively, as well as for beneficiaries treated by both types of providers.

Similar analyses were conducted to compare utilization of preventive services among patients treated by physicians in selected subspecialties, including general practice, internal medicine, family medicine, endocrinology and ophthalmology.

Predicting the Receipt of Preventive Services

Multiple regression analyses[c] were conducted to examine the correlation between patient and provider characteristics and the dependent variables - whether Medicare beneficiaries in the state received an HbA1c test and an eye exam for diabetic retinopathy. Separate models were conducted for each dependent variable.

Logistic regression is typically conducted in cases in which there is a dichotomous dependent variable. For the analyses described in this report, ordinary least squares, as opposed to logistic regression, was conducted because of the greater ease of computation and interpretation. When the frequency of the occurrence (the dependent variable) is not rare and the sample is large, as in this analysis, ordinary least squares and logistic regression produce comparable results.

The regression model specified was designed to assess the extent to which receipt of preventive tests was related to both patient and provider characteristics. Independent variables believed to be associated with receipt of these preventive measures – and which were tested in this analysis - included beneficiary age and gender, whether the beneficiary has one or more co-morbidities, beneficiary county of residence, and the type of provider(s) from whom patients sought treatment. These variables are further defined in Table II.1.

The results of this analysis provide information on the factors significantly associated with an increased or decreased likelihood of having received each of the diabetes preventive measures. Examining the coefficient of variation (R^2) also provides

[c] Regression analyses include several techniques that use statistical models or equations to measure the type and strength of a causal relationship among dependent and independent variables. (A dependent variable is the response variable whose behavior is being measured. An independent variable is the factor or factors whose effects are being studied or that are believed to have a causal effect on the dependent variable). Regression techniques are also used, as in this study, to identify independent variables that allow accurate prediction of the dependent variables. Regression models assume various forms (e.g., ordinary least squares, logistic regression) depending on the types of variables that are measured, whether the relationship between the dependent and independent variables are linear, and whether the model is being used for explanation or prediction.

information on how well the regression model predicts or explains the relationship between dependent and independent variables.[d]

[d] Values of R^2 range from 0 to 1, with higher values indicating a greater ability of the model to predict or explain variation in the dependent variable.

Table II.1: ***Variables Included in Analysis of Prevalence of Diabetes and Receipt of Preventive Services in Maryland***

Dependent Variables	**Description**
Receipt of HbA1c	A dichotomous variable, coded "1"if beneficiary received HbA1c test or "0" if they did not.
Receipt of Eye Exam	A dichotomous variable, coded "1" if benefic iary received an eye exam or "0" if they did not.
Independent Variables	**Description**
Age	Age is measured as a four-level categorical variable: less than 65 years, 65-74 years, 75-84 years, and 85 and over.
Gender	Gender was coded as a dichotomous variable where "0" indicated male and "1" indicated female.
County	Beneficiaries' county of residence were specified as 24 separate variables, corresponding to each Maryland county, where a value of "0" indicated the beneficiary did not reside in the county and a value of "1" indicated the beneficiary was a county resident.
Co-morbidities	The presence of co-morbidities was measured using the Ambulatory Diagnosis Group (ADG) classification system. This classification system groups conditions with selected diagnosis codes (ICD-9-CM) that are clinically similar, as well as similar in terms of utilization and costs. Beneficiaries may be assigned from 1 to 34 ADG groups depending upon whether the specific condition was present (coded as "1") or not (coded as "0"). For a more thorough discussion of the ADG system, refer to Weiner *et al.* 1996.[13]
Provider(s) of Care	The provider(s) of diabetes care was measured with seven variables, corresponding to whether beneficiaries received any care from a (1) general practitioner, (2) family physician, (3) internal medicine specialist, (4) endocrinologist, (5) ophthalmologist, (6) podiatrist, or (7) another type of physician not classified. These variables were not mutually exclusive. One or more visits to the selected provider type was indicated with a value of "1", and a value of "0", otherwise.

Section III: Findings

Beneficiaries who Received Diabetes Care and Diabetes Prevalence

Approximately 74,359 Medicare beneficiaries over the age of 65, who resided in the state of Maryland, received care for Type 1 or Type 2 diabetes, as shown in Table III.1. As discussed in the section on methods, if we assume that only a small proportion of beneficiaries with diabetes did not have a physician encounter, this figure estimates the prevalence of diabetes in this population at 14.1 percent. The estimated diabetes prevalence rate for elderly Medicare beneficiaries in Maryland is slightly lower than the national prevalence of diabetes for the Medicare population. Estimates from the 1996 Medicare Current Beneficiary Survey, a national longitudinal survey of Medicare beneficiaries conducted annually by HCFA, indicated that approximately 15.9 percent of all Medicare beneficiaries had diabetes.[13,e]

Estimates of diabetes prevalence varied significantly by county, with a low of 9.8 percent in Talbot County and a high of 17.4 percent in Charles County - a nearly two-fold difference. In addition to Talbot, counties with the lowest prevalence rates included Montgomery (11.9 percent), Baltimore (12.8 percent), Carroll (12.9 percent) and Kent (12.9 percent). In addition to Charles, counties with the highest prevalence rate of diabetes included St. Mary's (17.4 percent), Garrett (17.3 percent), Allegany (16.8 percent) and Prince George's (16.5 percent).

Diabetes prevalence rates also differed by region, as shown in Figure 1. Areas of Southern and Western Maryland had the highest prevalence of diabetes, around 17 percent, while central Maryland and the Eastern Shore had prevalence rates in the low teens. The two counties adjacent to Washington, D.C. showed contrasting results.

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[e] It is not possible to determine whether differences in state and national estimates reflect "true" differences or merely a data "artifact". State data on county population and rates of diabetes are based on utilization reported in claims records. National estimates were generated by HCFA from data gathered in the annual Medicare Current Beneficiary Survey. Comparison of self-reported and claims data may not produce comparable results.

Montgomery County, bordering the District of Columbia on the northeast side, had the second lowest diabetes prevalence rates in the state, 11.9 percent, while Prince George's County, on the southeast side, had among the highest prevalence rate, 16.5 percent.

Receipt of Diabetes Care by Gender and Age

An equal proportion of male and female Maryland residents over the age of 65 - 14 percent - received outpatient diabetes care. These rates would suggest that the prevalence of diabetes in this population is slightly lower than the national prevalence for both women (15.3 percent) and men (16.6 percent.)[e] Gender-specific estimates of diabetes prevalence, by county, are reported in Table III.2.

Statewide, the prevalence of diabetes care was estimated to be highest among Medicare beneficiaries between the ages of 75 and 84, reported in Table III.3. Approximately 15.4 percent of Medicare beneficiaries in this age group were estimated to have diabetes, compared to 13.5 percent of beneficiaries between the ages of 65 and 74 and 10.9 percent of beneficiaries 85 and over. State estimates of diabetes prevalence were slightly lower than rates reported by HCFA for all age groups. Compared to national prevalence rates, the prevalence of diabetes among Maryland Medicare beneficiaries was nearly 15 percent lower among beneficiaries aged 65-74, 5.5 percent lower for those aged 75-84, and 15.5 percent lower among beneficiaries over the age of 85.[e]

Type of Providers Who Treat Patients with Diabetes

Across Maryland, almost 56 percent of Medicare elderly beneficiaries who received diabetes care were exclusively treated by primary care physicians and 18 percent were exclusively treated by specialist physicians, as shown in Table III.4.[f] The remaining 25 percent sought treatment from both primary care and specialty providers. The

proportion of this population treated exclusively by specialists, however, varied by an eight-fold difference across counties in the state. Cecil, Kent, and Garrett counties, with 4.5 percent, 4.6 percent and 7.3 percent of the population exclusively treated by a specialist physician, had the lowest rates. Counties with the highest proportion of beneficiaries who were exclusively treated by specialist providers included Prince George's (36.9 percent) and Montgomery (34.1 percent).

As noted in Table III.5, 39.7 percent of elderly Medicare beneficiaries with one or more outpatient visit sought care from only internal medicine specialists, 11.0 percent sought care from only family practitioners, and 2.5 percent sought care from only general practitioners. An internal medicine specialist as well as another type of specialist physician treated another 22.6 percent of beneficiaries.

Only 5.9 percent of the Maryland Medicare over-65 population with diabetes received care (either exclusively or in combination with other types of providers) from an endocrinologist. Similarly, only a small fraction of this population, 6.3 percent, visited an ophthalmologist at least once during the year, shown in Table III.6. These observations are of particular interest given that endocrinologists are often considered specialists in the treatment of diabetes and ophthalmologists specialists in the treatment of diabetic eye disease.

Rates of Receipt of Preventive Services

HbA1c Testing

On average, 59.3 percent of Maryland Medicare beneficiaries who received diabetes care also received at least one HbA1c test during calendar year 1997. As shown in Table III.7, rates of HbA1c receipt ranged from a low of 47.9 percent in Somerset County to a high of 70.9 percent in Garrett County.

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[f] As noted in the discussion of methods, beneficiaries with either primary care physician(s) or specialist physician(s) as their exclusive provider of care may have visited more than one physician. All providers

Rates of receipt of HbA1c were highest in Garrett County (70.9 percent), Queen Anne's County (67.5 percent), Howard County (66.8 percent), and Montgomery County (65.9 percent). Shown in Figure 2, counties with low rates of use of HbA1c were also scattered throughout the state, including Somerset (47.9 percent), Worcester (50.5 percent), and Kent County (50.7 percent) on the Eastern Shore; Calvert County (49.7 percent) in the south; and Allegany County (53.1 percent) in Western Maryland.

Type of provider influenced rates of HbA1c testing, shown in Table III.8. Nearly 58.5 percent of beneficiaries who received care exclusively from primary care physicians received an HBA1c test in 1997, compared to only 50.7 percent of beneficiaries who received care exclusively from a specialist. Rates of receipt of HbA1c were substantially higher (68.3 percent) for beneficiaries who received care from both primary care and specialist physicians.

As reported in Tables III.9 and III.10, dramatic differences by provider subspecialty were also noted. Among the primary care subspecialties, HbA1c use rates were highest among beneficiaries who received care exclusively from a family practitioner (60.1 percent) and lowest for beneficiaries whose care was provided exclusively by general practitioners (42.4 percent). Among specialty physicians, rates of HbA1c use were highest among beneficiaries treated exclusively by an endocrinologist (82.6 percent). Not surprisingly, given their narrower clinical focus, HbA1c use rates were lowest among beneficiaries exclusively treated by podiatrists (20.7 percent) and ophthalmologists (27.3 percent). Importantly, rates of HbA1c receipt were consistently higher where multiple types of physicians treated beneficiaries. Rates of HbA1c use were highest (88.2 percent) among beneficiaries who sought treatment from both endocrinologists and another provider type.

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visited, however, were either primary care or specialty providers.

Eye Exams

Over 44 percent of Maryland Medicare beneficiaries who received diabetes care also received an eye exam in 1997. The rates of diabetic eye exams differed substantially across regions of the state, as shown in Table III.7 and Figure 3. Counties with the highest rates – those in which at least half of the Medicare diabetic population over the age of 65 received an eye exam – included Worcester (55.1 percent), Harford (52.8 percent), Montgomery (52.5 percent), Wicomico (51.0 percent) and Carroll (50.6 percent). Counties with the lowest eye exam rates included Charles (35.5 percent) and St. Mary's (38.0 percent) in Southern Maryland, Washington (35.8 percent) and Garrett (35.8 percent) in Western Maryland, Howard (37.6 percent) and Baltimore City (38.1 percent) in Central Maryland.

As with receipt of HbA1c, the type of provider influenced rates of eye exams, shown in Table III.11. The percentage of beneficiaries who received an eye exam in 1997 was lowest among individuals exclusively treated by primary care physicians (41.7 percent). Although eye exam rates were higher among beneficiaries exclusively treated by specialists (45.1 percent), beneficiaries treated by both primary and specialist physicians were more likely to receive an eye exam. Nearly 51 percent with visits to primary and specialty physicians received a diabetic eye exam in 1997.

Even when subspecialties are compared, beneficiaries who received treatment from more than one type of provider were found to have higher eye exam rates than beneficiaries who were treated exclusively by one provider of a specific subspecialty. For example, as noted in Tables III.12 and III.13, eye exam rates were highest for beneficiaries treated by either an endocrinologist (61.2 percent) or ophthalmologist (57.8 percent) in combination with another provider type than for beneficiaries treated exclusively by an endocrinologist (53.1 percent) or ophthalmologist (54.7 percent). Similarly, among the primary care subspecialties, eye exam rates were highest for those that received care from an internal medicine specialist in combination with another type

of physician (49.5 percent) than for beneficiaries exclusively treated by an internal medicine specialist (42.5 percent).

Factors that Predict Use of Preventive Services

The low R^2 values associated with the regression model of utilization of HbA1c (.087) and eye exams (.077) indicate that much of the variation in receipt of these clinical preventive services could not be explained by the factors included in these models. It is possible that there are other patient and provider-related variables that are important in predicting whether or not patients with diabetes receive these services. For example, even though measures of co-morbidity were included in these models, these measures did not provide specific information on whether patients were suffering from diabetes complications. Additionally, physician information available for this analysis was limited to specialty. Other provider characteristics, including years in practice and type of practice (e.g., group, private or hospital-based practice), could influence the services that patients with diabetes received from their physicians. Although data limitations did not permit the inclusion of these variables in this analysis, it is possible that information of this nature could enhance the ability of the models to explain variation in utilization of clinical preventive services.

Regardless of this limitation, certain patient characteristics and provider specialty were significantly related to whether or not elderly Medicare beneficiaries with diabetes received an HbA1c test or a screening to detect diabetic retinopathy.

HbA1c Testing

Results of the regression analysis, shown in Table III.14, indicated that men and women were equally likely to have received HbA1c testing. However, the likelihood that a patient with diabetes received an HbA1c test varies significantly by age. Medicare beneficiaries between the ages of 65 and 74 were the most likely to have received an HbA1c test and those age 85 and over were the least likely to have received an HbA1c test. In fact, beneficiaries between the ages of 75 and 84 were nearly 4 percentage points less likely and those age 85 and over were almost 12 percentage points less likely than beneficiaries between the ages of 65 and 74 to have received an HbA1c test.

The likelihood of receiving an HbA1c test was also significantly related to beneficiaries' county of residence. Elderly Medicare beneficiaries who received diabetes care had the greatest likelihood of receiving an HBA1c test if they resided in Garrett County. Compared to beneficiaries who resided in Howard and Caroline, counties with the next highest likelihood rates, beneficiaries residing in Garrett County were 5 percentage points more likely to have received an HbA1c test.

Patients residing in the counties of Somerset, Kent, Worchester, and Calvert were the least likely to have received an HbA1c test. Relative to beneficiaries residing in Howard County, those residing in these counties were between 12 and 15 percentage points less likely to have received an HbA1c test.

The likelihood that a patient received an HbA1c was significantly associated with whether or not the patient incorporated selected provider types into their care. Across the primary care specialties, the likelihood of receiving an HbA1c was greatest among patients who had at least one visit to an internal medicine physician, followed by those with visits to a family practitioner. Patients who visited an internal medicine specialist were 18 percentage points more likely and those who visited a family practitioner were 16 percentage points more likely to have received an HbA1c test compared to patients who did not use these types of providers. Interestingly, incorporating a visit to a general practitioner had no effect on the likelihood of receiving an HbA1c.

Incorporating a visit to any specialist increased the likelihood of receiving an HbA1c. However, with the exception of patients who visited an endocrinologist, the magnitude of the "specialty effect" was relatively small. Patients who visited an endocrinologist at least once had the greatest likelihood of receiving an HbA1c exam; the likelihood of receiving an HbA1c test was 30 percentage points higher among patients who visited an endocrinologist, compared to those who did not.

Eye Exam

Gender, which had no bearing on the likelihood of receiving an HbA1c test, also had no effect on the likelihood that a patient with diabetes would receive an eye exam. The likelihood of receiving an eye exam varied by age and was highest among patients between the ages of 75-84 and lowest for patients age 85 and over.

The likelihood of having received an eye exam was higher for patients residing in almost all counties in Maryland than for patients residing in Howard County. (The likelihood of receiving an eye exam was comparable among patients residing in Howard, Calvert, Charles, Garrett, St. Mary's and Washington Counties.) Counties in which patients had the greatest likelihood of receiving an eye exam included Carroll, Harford, Wicomico, and Worcester. Patients in these counties were between 17 and 22 percentage points more likely to have received an eye exam compared to patients in Howard County.

Patients who made one or more visits to either an endocrinologist or an ophthalmologist were the most likely to have received an eye exam; likelihood rates for patients visiting either of these two specialists were approximately 12 percentage points higher than for those who did not. Patients who visited an internal medicine specialist were slightly more likely to have received an eye exam than those who did not; however, a visit to either a general or family practitioner had no effect on the likelihood of receiving an eye exam.

Physician Supply and Use of Preventive Services

A county-level regression analysis was conducted to determine whether observed differences in utilization of HbA1c and eye exams could be related to differences in the supply of primary and specialist providers in counties across the state (results are not shown). The regression model specified the percentage of elderly Medicare beneficiaries in the county who had received the preventive service as the dependent variable and per capita income and primary care and specialty physician-to-population ratios as

independent variables. Separate models were specified for HbA1c and eye exams. No relationship between supply of primary and specialist providers and receipt of either HbA1c or diabetic eye exams was detected.

Table III.1: ***Maryland Medicare Beneficiaries, Over Age 65, who Received Diabetes Care, and Estimates of Diabetes Prevalence, by County, 1997***

County	Medicare Beneficiaries (N)[g]	Medicare Beneficiaries who Received Diabetes Care (N)	Estimated Prevalence of Diabetes[h] (%)	State Rank (Highest to Lowest by Receipt of Care)
Allegany	13,563	2,281	16.8	4
Anne Arundel	43,877	6,479	14.8	10
Baltimore	99,313	12,674	12.8	22
Baltimore City	85,304	12,895	15.1	8
Calvert	5,637	827	14.7	11
Caroline	3,880	535	13.8	16
Carroll	16,046	2,070	12.9	20
Cecil	7,649	1,092	14.3	14
Charles	7,310	1,275	17.4	1
Dorchester	4,997	704	14.1	15
Frederick	15,625	2,527	16.2	6
Garrett	3,711	640	17.2	3
Harford	18,392	2,481	13.5	18
Howard	11,981	1,553	13.0	19
Kent	3,927	505	12.9	21
Montgomery	79,809	9,480	11.9	23
Prince George's	49,737	8,199	16.5	5
Queen Anne's	3,966	542	13.7	17
St. Mary's	6,589	1,144	17.4	2
Somerset	3,309	489	14.8	9
Talbot	6,316	622	9.8	24
Washington	16,974	2,731	16.1	7
Wicomico	9,853	1,426	14.5	12
Worcester	8,243	1,188	14.4	13
State prevalence	526,008	74,359	14.1	
National prevalence[i]	39,385,000		15.9	

[g] Number of Medicare beneficiaries in Maryland obtained from the Health Care Financing Administration.
[h] Estimates of diabetes prevalence are based on receipt of care, which may tend to underestimate actual prevalence rates.
[i] As reported in "Characteristics and Perceptions of the Medicare Population (1996). http://www.hcfa.gov/mcbs/HCFAsvs/cp96s1.pdf.

Table III.2: ***Maryland Medicare Beneficiaries Over Age 65 who Received Diabetes Care, and Estimates of Diabetes Prevalence, by Sex and County, 1997***

County	Women	Men
	Received Diabetes Care (%)	Received Diabetes Care (%)
Allegany	16.7	16.9
Anne Arundel	14.9	14.7
Baltimore	13.3	12.4
Baltimore City	13.9	15.8
Calvert	13.4	15.6
Caroline	13.6	14.0
Carroll	13.4	12.6
Cecil	13.1	15.3
Charles	16.9	17.8
Dorchester	11.8	15.7
Frederick	15.7	16.5
Garrett	14.3	19.5
Harford	14.0	13.1
Howard	13.6	12.5
Kent	12.9	12.8
Montgomery	13.0	11.1
Prince George's	16.0	16.8
Queen Anne's	13.1	14.1
St. Mary's	17.1	17.6
Somerset	13.0	16.1
Talbot	10.6	9.3
Washington	15.7	16.4
Wicomico	13.9	14.9
Worcester	15.6	13.5
State prevalence[j]	14.1	14.2
National prevalence[k]	15.3	16.6

[j] Estimates of diabetes prevalence are based on receipt of care, which may tend to underestimate actual prevalence rates.

[k] As reported in "Characteristics and Perceptions of the Medicare Population (1996). http://www.hcfa.gov/mcbs/HCFAsvs/cp96s1.pdf.

Table III.3: ***Maryland Medicare Beneficiaries Over Age 65 who Received Diabetes Care, and Estimates of Diabetes Prevalence, by Age and County, 1997***

County	Ages 65-74	Ages 75-84	Ages 85+
	(%)	(%)	(%)
Allegany	17.0	17.1	12.9
Anne Arundel	13.9	16.4	11.9
Baltimore	12.0	14.3	9.8
Baltimore City	15.2	15.8	10.7
Calvert	14.0	15.1	13.4
Caroline	14.4	13.2	10.9
Carroll	13.3	13.2	8.6
Cecil	13.5	16.1	10.8
Charles	17.2	17.3	16.8
Dorchester	13.6	15.4	9.9
Frederick	15.6	17.6	12.5
Garrett	17.0	18.3	12.5
Harford	12.7	15.4	10.0
Howard	11.8	14.6	12.0
Kent	11.8	15.3	9.0
Montgomery	10.6	13.6	10.6
Prince George's	15.3	19.0	13.5
Queen Anne's	13.3	14.5	10.2
St. Mary's	17.1	18.6	12.2
Somerset	15.3	15.0	9.7
Talbot	9.1	10.9	8.4
Washington	16.6	16.5	10.8
Wicomico	14.4	15.2	10.5
Worcester	15.2	14.3	9.1
State prevalence[l]	13.5	15.4	10.9
National prevalence[m]	15.8	16.3	12.9

[l] Estimates of diabetes prevalence are based on receipt of care, which may tend to underestimate actual prevalence rates.
[m] Adapted from "Characteristics and Perceptions of the Medicare Population (1996). http://www.hcfa.gov/mcbs/HCFAsvs/cp96s1.pdf.

Table III.4: ***Maryland Medicare Beneficiaries with Diabetes with Visits to Primary and Specialty Care Physicians, by County, 1997***

County	Medicare Beneficiaries who Received Diabetes Care (N)	Primary Care Physician Visit(s) Only (%)	Specialist Physician Visit(s) Only (%)	Primary and Specialty Care Physician Visit(s) (%)
Allegany	2,281	64.7	14.8	19.7
Anne Arundel	6,479	62.8	13.1	22.9
Baltimore	12,674	60.2	11.0	27.3
Baltimore City	12,895	57.6	13.4	25.9
Calvert	827	58.3	13.7	27.4
Caroline	535	61.3	11.6	26.7
Carroll	2,070	65.8	10.0	23.5
Cecil	1,092	75.6	4.5	18.9
Charles	1,275	39.1	27.7	32.2
Dorchester	704	59.5	8.1	31.7
Frederick	2,527	65.0	10.8	23.5
Garrett	640	68.9	7.3	23.0
Harford	2,481	60.5	9.3	29.1
Howard	1,553	51.5	18.0	29.5
Kent	505	71.7	4.6	23.2
Montgomery	9,480	42.1	34.1	22.8
Prince George's	8,199	37.2	36.9	24.9
Queen Anne's	542	64.4	8.7	26.0
Somerset	489	51.7	21.1	26.0
St. Mary's	1,144	46.0	29.1	24.2
Talbot	622	56.3	11.1	31.4
Washington	2,731	71.3	9.5	18.3
Wicomico	1,426	60.7	13.0	25.5
Worcester	1,188	61.2	11.5	26.3
State total*	74,359	55.6	18.0	25.0

* State total does not add to 100 percent due to missing data.

Table III.5: ***Maryland Medicare Beneficiaries with Diabetes with Visits to Primary and Specialty Care Subspecialists, by County, 1997***

County	Medicare Beneficiaries with Diabetes (N)	General Practice (GP)		Family Practice (FP)		Internal Medicine (IM)		Endocrinology (End.)	
		GP Only (%)	GP Plus Other Specialty (%)	FP Only (%)	FP Plus Other Specialty (%)	IM Only (%)	IM Plus Other Specialty (%)	End. Only (%)	End. Plus Other Specialty (%)
Allegany	2,281	3.7	2.0	17.0	8.9	41.4	16.3	1.8	5.1
Anne Arundel	6,479	3.3	2.0	11.5	6.4	45.6	21.6	0.7	1.7
Baltimore	12,674	1.7	1.4	5.6	5.1	50.8	26.9	1.4	3.6
Baltimore City	12,895	1.9	1.5	3.4	3.5	50.7	25.5	1.5	3.4
Calvert	827	0.5	0.4	14.5	8.9	41.1	23.9	0.2	3.5
Caroline	535	10.8	6.4	30.8	18.1	16.3	14.2	0.7	3.7
Carroll	2,070	3.5	3.8	21.4	14.3	35.0	21.7	0.6	1.0
Cecil	1,092	4.8	3.3	41.2	14.6	24.9	12.5	0.5	1.5
Charles	1,275	2.4	2.6	8.9	10.6	25.6	26.8	1.3	4.9
Dorchester	704	2.4	1.1	24.1	20.5	25.7	29.8	1.6	8.7
Frederick	2,527	4.6	3.0	25.2	12.8	31.8	17.5	0.2	1.1
Garrett	640	1.1	0.6	41.7	23.4	19.8	15.9	0.3	3.0
Harford	2,481	1.3	1.2	11.4	9.2	44.7	27.9	0.4	1.0
Howard	1,553	1.6	0.8	6.4	8.0	41.9	26.1	3.2	7.6
Kent	505	7.1	5.0	22.6	11.7	37.6	20.8	0.0	2.2
Montgomery	9,480	1.3	1.5	7.2	5.2	32.4	20.3	3.3	9.8
Prince George's	8,199	2.5	2.0	8.4	7.1	25.0	20.3	2.4	5.8
Queen Anne's	542	6.8	5.2	25.1	14.6	28.2	21.8	0.6	3.0
Somerset	489	6.3	7.6	11.5	8.0	30.1	22.5	0.0	2.7
St. Mary's	1,144	1.9	1.3	16.4	11.0	24.7	21.3	0.9	4.7
Talbot	622	6.3	3.7	21.5	15.8	25.9	21.9	0.5	6.4
Washington	2,731	2.8	2.7	27.6	9.0	37.7	15.2	0.1	2.9
Wicomico	1,426	2.5	2.3	12.0	7.7	44.4	21.3	0.1	4.3
Worcester	1,188	7.5	7.8	20.0	14.6	28.3	19.3	0.7	4.2
State total	74,359	2.5	2.0	11.0	7.3	39.7	22.6	1.5	4.4

Table III.6: ***Maryland Medicare Beneficiaries with Diabetes with Visits to Primary and Specialty Care Subspecialists, by County, 1997***

County	Medicare Beneficiaries with Diabetes (N)	Podiatry (Pod.)		Ophthalmology (Oph.)		Uncategorized (Unc.)	
		Pod. Only (%)	Pod. Plus Other Specialty (%)	Oph. Only (%)	Oph. Plus Other Specialty (%)	Unc. Only (%)	Unc. Plus Other Listed Specialty (%)
Allegany	2,281	0.7	5.0	0.7	6.8	9.7	11.4
Anne Arundel	6,479	1.5	8.8	0.4	4.4	9.0	15.1
Baltimore	12,674	1.7	10.7	0.7	5.8	5.6	17.2
Baltimore City	12,895	2.0	10.3	0.9	5.2	7.3	16.3
Calvert	827	2.3	13.1	0.0	4.6	8.1	18.1
Caroline	535	4.5	11.6	1.1	6.0	4.9	12.5
Carroll	2,070	1.1	8.0	0.3	3.2	7.1	17.2
Cecil	1,092	0.6	6.8	0.1	2.5	3.0	11.2
Charles	1,275	1.7	9.6	1.8	14.9	16.3	26.1
Dorchester	704	1.8	8.9	0.3	4.0	3.3	19.6
Frederick	2,527	0.9	7.0	0.5	8.3	7.9	14.8
Garrett	640	0.5	3.6	0.5	4.4	5.3	17.0
Harford	2,481	1.5	9.5	0.4	3.3	6.1	22.1
Howard	1,553	1.7	9.7	1.4	13.6	7.4	16.3
Kent	505	1.0	9.7	0.0	2.6	3.2	15.2
Montgomery	9,480	1.6	10.9	0.5	5.3	20.9	20.7
Prince George's	8,199	1.9	10.9	0.9	8.3	24.3	22.4
Queen Anne's	542	1.5	12.0	0.4	4.2	4.8	14.4
Somerset	489	1.8	8.0	0.2	2.7	17.2	21.1
St. Mary's	1,144	2.0	11.8	0.6	4.1	19.6	21.9
Talbot	622	3.1	15.9	1.1	7.9	4.2	15.1
Washington	2,731	1.1	7.8	0.3	2.0	6.6	11.8
Wicomico	1,426	1.2	8.9	0.1	3.1	10.0	18.2
Worcester	1,188	1.4	9.4	0.5	3.9	7.1	18.2
State total	74,359	1.6	9.8	0.6	5.7	11.0	17.7

Table III.7: ***Utilization of HbA1c and Eye Exams by Maryland Medicare Beneficiaries who Received Diabetes Care, By County, 1997***

County	Receipt of HbA1c		Receipt of Eye Exam	
	Use Rate (%)	Rank	Use Rate (%)	Rank
Allegany	53.1	20	40.2	17
Anne Arundel	59.2	11	44.0	13
Baltimore	60.5	9	47.7	7
Baltimore City	55.5	17	38.1	19
Calvert	49.7	23	39.1	18
Caroline	63.0	6	40.9	15
Carroll	60.1	10	50.6	5
Cecil	60.8	8	45.0	10
Charles	58.6	14	35.5	23
Dorchester	57.0	16	44.7	12
Frederick	57.5	15	49.8	6
Garrett	70.9	1	35.8	22
Harford	61.5	7	52.8	2
Howard	66.8	3	37.6	21
Kent	50.7	21	45.0	11
Montgomery	65.9	4	52.5	3
Prince George's	59.0	12	40.6	16
Queen Anne's	67.5	2	46.9	8
Somerset	47.9	24	43.8	14
St. Mary's	63.6	5	38.0	20
Talbot	54.8	18	45.2	9
Washington	54.2	19	35.8	22
Wicomico	58.9	13	51.0	4
Worcester	50.5	22	55.1	1
State total	59.3		44.4	

Table III.8: ***HbA1c Utilization Rates for Maryland Medicare Beneficiaries who Received Diabetes Care by Specialty and County, 1997***

County	Primary Care Physician Only (%)	Specialist Physician Only (%)	Both Primary and Specialty Care Physicians (%)
Allegany	51.3	46.4	65.0
Anne Arundel	59.5	47.4	66.6
Baltimore	59.4	43.7	70.5
Baltimore City	55.3	40.5	64.3
Calvert	49.4	35.4	58.6
Caroline	61.3	54.8	70.6
Carroll	61.7	34.5	67.1
Cecil	59.9	36.7	71.4
Charles	61.5	42.8	69.8
Dorchester	55.8	50.9	61.0
Frederick	56.6	44.5	67.2
Garrett	74.4	36.2	72.1
Harford	63.9	27.4	68.2
Howard	66.4	56.1	74.7
Kent	48.6	30.4	61.5
Montgomery	63.3	62.8	76.2
Prince George's	57.6	55.0	68.1
Queen Anne's	67.9	42.6	77.3
Somerset	51.0	30.1	57.5
St. Mary's	55.7	69.7	72.2
Talbot	53.7	31.9	67.2
Washington	54.9	39.6	60.1
Wicomico	61.1	38.9	65.1
Worcester	51.3	24.8	60.4
State total	58.5	50.7	68.3

Table III.9: ***HbA1c Utilization by Physician Subspecialty for Maryland Medicare Beneficiaries Who Received Diabetes Care, by County, 1997***

County	General Practice (GP)		Family Practice (FP)		Internal Medicine (IM)		Endocrinology (End.)	
	GP Only (%)	GP Plus Other Specialty (%)	FP Only (%)	FP Plus Other Specialty (%)	IM Only (%)	IM Plus Other Specialty (%)	End. Only (%)	End. Plus Other Specialty (%)
Allegany	52.4	63.0	65.6	70.1	44.9	61.8	90.5	88.8
Anne Arundel	36.6	60.6	60.9	70.3	60.2	67.5	82.6	90.0
Baltimore	38.7	61.5	61.2	68.0	59.9	69.8	83.8	89.5
Baltimore City	42.1	51.1	51.2	65.5	55.8	64.9	82.7	88.5
Calvert	75.0	33.3	63.3	71.6	43.2	55.6	100.0	93.1
Caroline	41.4	64.7	73.3	72.2	52.9	64.5	100.0	100.0
Carroll	51.4	68.4	63.2	68.7	60.8	67.3	100.0	95.0
Cecil	46.2	50.0	64.0	75.5	54.0	70.8	100.0	81.3
Charles	58.1	72.7	49.6	64.4	64.5	72.2	68.8	91.9
Dorchester	35.3	75.0	57.6	61.8	53.6	62.4	81.8	77.0
Frederick	34.5	48.1	63.0	65.6	54.4	68.8	25.0	81.5
Garrett	28.6	75.0	75.3	74.7	71.7	75.5	0.0	100.0
Harford	31.3	62.1	65.2	73.8	64.0	68.6	72.7	88.5
Howard	36.0	66.7	60.0	69.4	68.5	75.8	79.6	97.5
Kent	63.9	56.0	60.5	61.0	38.4	56.2	*	81.8
Montgomery	58.4	72.9	58.6	72.8	64.0	76.4	86.3	88.4
Prince George's	49.0	63.1	51.4	62.9	60.4	69.3	77.8	84.6
Queen Anne's	78.4	85.7	67.6	82.3	62.1	77.1	66.7	100.0
Somerset	19.4	27.0	53.6	64.1	57.1	59.1	*	69.2
St. Mary's	63.6	73.3	44.1	69.0	61.8	70.9	90.0	92.6
Talbot	46.2	60.9	53.0	63.3	57.8	64.0	66.7	95.0
Washington	27.3	48.0	58.9	62.9	53.5	61.3	66.7	83.3
Wicomico	5.6	24.2	67.3	76.4	62.4	66.1	100.0	93.5
Worcester	28.1	32.3	55.5	66.5	56.0	55.9	50.0	72.0
State total	42.4	57.6	60.1	68.3	58.7	68.4	82.6	88.2

* Beneficiaries did not exclusively visit specialists of this type in this county.

Table III.10: ***HbA1c Utilization by Physician Subspecialty for Maryland Medicare Beneficiaries Who Received Diabetes Care, By County, 1997***

County	Podiatry (Pod.)		Ophthalmology (Oph.)		Uncategorized (Unc.)	
	Pod. Only (%)	Pod. Plus Other Specialty (%)	Oph. Only (%)	Oph. Plus Other Specialty (%)	Unc. Only (%)	Unc. Plus Other Listed Specialty (%)
Allegany	37.5	61.7	26.7	68.2	35.3	58.7
Anne Arundel	16.5	62.3	42.9	64.6	46.5	67.6
Baltimore	24.5	68.5	25.3	73.2	34.2	69.3
Baltimore City	23.3	66.1	28.3	70.8	29.8	61.9
Calvert	10.5	51.9	*	65.8	34.3	54.7
Caroline	50.0	72.6	83.3	75.0	42.3	62.7
Carroll	26.1	70.9	28.6	77.6	26.5	62.1
Cecil	0.0	66.2	0.0	74.1	36.4	73.0
Charles	13.6	70.5	8.7	75.3	38.9	63.1
Dorchester	38.5	50.8	50.0	67.9	34.8	58.7
Frederick	20.8	68.4	38.5	73.0	45.0	64.3
Garrett	0.0	60.9	66.7	96.4	35.3	64.2
Harford	10.5	66.1	33.3	75.9	23.2	67.2
Howard	34.6	68.0	27.3	78.2	41.7	72.7
Kent	40.0	67.3	*	69.2	25.0	58.4
Montgomery	16.9	77.1	22.7	78.5	57.7	74.2
Prince George's	16.5	70.2	26.0	74.0	51.7	66.0
Queen Anne's	12.5	76.9	0.0	87.0	42.3	71.8
Somerset	44.4	64.1	0.0	61.5	27.4	53.4
St. Mary's	17.4	74.1	28.6	76.6	72.3	73.7
Talbot	15.8	65.7	14.3	61.2	30.8	59.6
Washington	12.9	62.3	33.3	61.1	41.1	54.2
Wicomico	11.8	62.2	0.0	56.8	38.0	61.8
Worcester	5.9	54.5	0.0	69.6	17.9	59.7
State total	20.7	68.1	27.3	72.9	45.7	66.4

* Beneficiaries did not exclusively visit specialists of this type in this county.

Table III.11: ***Eye Exam Utilization Rates for Maryland Medicare Beneficiaries Who Received Diabetes Care, by Specialty and County, 1997***

County	Primary Care Physician Only (%)	Specialist Physician Only (%)	Both Primary and Specialty Care Physicians (%)
Allegany	38.2	37.6	48.8
Anne Arundel	42.2	43.2	50.2
Baltimore	45.4	46.4	53.8
Baltimore City	35.6	40.0	43.6
Calvert	37.6	38.9	42.7
Caroline	41.5	35.5	42.7
Carroll	49.7	43.7	56.8
Cecil	42.5	40.8	55.8
Charles	29.5	38.5	40.5
Dorchester	40.8	36.8	55.2
Frederick	45.0	50.4	62.9
Garrett	35.1	34.0	38.8
Harford	51.4	51.3	57.0
Howard	35.9	32.9	43.9
Kent	42.8	34.8	54.7
Montgomery	47.3	55.5	57.8
Prince George's	38.6	40.5	44.2
Queen Anne's	43.8	44.7	56.0
Somerset	41.5	42.7	48.8
St. Mary's	32.9	36.9	49.5
Talbot	43.7	40.6	50.8
Washington	32.9	40.0	45.5
Wicomico	47.3	49.7	60.2
Worcester	52.8	52.6	62.0
State total	41.7	45.1	50.6

Table III.12: ***Eye Exam Utilization by Physician Subspecialty for Maryland Medicare Beneficiaries Who Received Diabetes Care By County, 1997***

County	General Practice (GP)		Family Practice (FP)		Internal Medicine (IM)		Endocrinology (End.)	
	GP Only (%)	GP Plus Other Specialty (%)	FP Only (%)	FP Plus Other Specialty (%)	IM Only (%)	IM Plus Other Specialty (%)	End. Only (%)	End. Plus Other Specialty (%)
Allegany	33.3	37.0	38.0	46.1	39.2	46.8	50.0	50.9
Anne Arundel	38.0	40.9	42.0	48.0	42.8	49.0	34.8	56.4
Baltimore	43.4	50.5	41.5	49.4	45.8	53.4	57.0	61.3
Baltimore City	31.2	38.9	28.7	36.0	36.4	42.7	56.3	56.2
Calvert	0.0	0.0	38.3	43.2	36.5	44.4	100.0	51.7
Caroline	41.4	47.1	41.2	46.4	39.1	38.2	50.0	70.0
Carroll	48.6	58.2	49.9	59.9	48.9	53.9	69.2	55.0
Cecil	46.2	55.6	44.2	52.8	37.1	56.2	16.7	68.8
Charles	19.4	39.4	23.9	43.0	31.5	40.6	37.5	61.3
Dorchester	47.1	37.5	38.2	53.5	42.0	51.9	36.4	75.4
Frederick	40.5	54.5	45.1	57.0	45.1	62.3	75.0	55.6
Garrett	28.6	0.0	34.1	38.7	35.4	37.3	50.0	47.4
Harford	56.3	62.1	52.8	52.0	51.2	56.2	81.8	57.7
Howard	48.0	16.7	35.0	37.1	35.7	45.7	36.7	50.0
Kent	38.9	64.0	45.6	49.2	41.1	50.5	*	54.5
Montgomery	36.0	50.0	44.1	50.3	48.8	56.3	56.6	69.0
Prince George's	28.7	42.9	32.6	44.8	41.5	43.5	49.0	54.7
Queen Anne's	35.1	42.9	39.0	67.1	47.7	54.2	66.7	62.5
Somerset	29.0	29.7	50.0	53.8	41.5	47.3	*	69.2
St. Mary's	36.4	46.7	31.9	46.8	32.9	47.1	40.0	59.3
Talbot	43.6	43.5	42.5	39.8	46.0	53.7	100.0	67.5
Washington	42.9	37.3	29.4	41.6	34.7	43.0	0.0	52.6
Wicomico	41.7	42.4	42.1	68.2	49.1	55.9	100.0	80.6
Worcester	43.8	48.4	51.7	63.0	56.3	61.1	75.0	64.0
State total	37.8	45.4	39.8	48.6	42.5	49.5	53.1	61.2

* Beneficiaries did not exclusively visit specialists of this type in this county.

Table III.13: ***Eye Exam Utilization by Physician Subspecialty for Maryland Medicare Beneficiaries Who Received Diabetes Care By County, 1997***

County	Podiatry (Pod.)		Ophthalmology (Oph.)		Uncategorized (Unc.)	
	Pod. Only (%)	Pod. Plus Other Specialty (%)	Oph. Only (%)	Oph. Plus Other Specialty (%)	Unc. Only (%)	Unc. Plus Other Listed Specialty (%)
Allegany	50.0	45.2	60.0	48.1	32.1	45.6
Anne Arundel	38.1	48.9	57.1	60.0	43.2	49.3
Baltimore	38.0	52.6	48.3	62.4	43.0	52.7
Baltimore City	24.1	42.3	67.3	57.8	33.6	43.9
Calvert	21.1	49.1	*	55.3	38.8	40.7
Caroline	25.0	53.2	16.7	46.9	46.2	28.4
Carroll	52.2	53.9	57.1	68.7	39.5	55.3
Cecil	28.6	55.4	100.0	81.5	45.5	52.5
Charles	27.3	53.3	43.5	42.1	33.2	40.8
Dorchester	23.1	42.9	100.0	60.7	30.4	55.1
Frederick	41.7	66.7	53.8	74.4	49.0	57.9
Garrett	33.3	34.8	33.3	64.3	35.3	31.2
Harford	42.1	52.5	33.3	77.1	51.0	57.3
Howard	11.5	50.7	36.4	46.9	20.9	44.7
Kent	0.0	57.1	*	76.9	43.8	49.4
Montgomery	37.7	62.9	61.4	62.5	53.5	56.1
Prince George's	27.2	50.7	46.6	46.4	37.9	43.0
Queen Anne's	37.5	53.8	50.0	60.9	46.2	55.1
Somerset	44.4	61.5	100.0	53.8	40.5	44.7
St. Mary's	26.1	46.7	14.3	42.6	38.4	44.6
Talbot	31.6	45.5	57.1	49.0	38.5	45.7
Washington	35.5	46.2	88.9	68.5	38.3	42.4
Wicomico	41.2	59.8	100.0	81.8	45.8	58.3
Worcester	58.8	62.5	83.3	80.4	44.0	59.3
State total	32.7	51.7	54.7	57.8	42.3	49.3

* Beneficiaries did not exclusively visit specialists of this type in this county.

Table III.14: ***Factors Affecting the Likelihood of Receiving HbA1c and Eye Exams***

(N = 73,317)

Patient Characteristics	HbA1c	Eye Exams
R^2	0.087	0.077
Gender (relative to males)		
Females	-0.0071	0.0029
Age (relative to ages 65-74)		
Age 75-84	-0.0375	0.0376
Age 85+	-0.1184	-0.0256
Physicians		
General Practice	0.0142	-0.0082
Family Practice	0.1596	0.0075
Internal Medicine	0.1756	0.0291
Endocrinology	0.3040	0.1251
Podiatry	0.0221	0.0127
Ophthalmology	0.0405	0.1215
Other	0.0489	0.0263
County (relative to Howard County)		
Allegany	-0.1076	0.0613
Anne Arundel	-0.0485	0.0897
Baltimore	-0.0485	0.1175
Baltimore City	-0.0775	0.0448
Calvert	-0.1520	0.0381
Caroline	0.0098	0.0958
Carroll	-0.0372	0.1715
Cecil	-0.0292	0.1084
Charles	-0.0453	-0.163
Dorchester	-0.1147	0.1122
Frederick	-0.0645	0.1481
Garrett	0.0499	0.0170
Harford	-0.0218	0.1894
Kent	-0.1445	0.1114
Montgomery	-0.0051	0.1323
Prince George's	-0.0399	0.0407
Queen Anne's	0.0236	0.1263
Somerset	-0.1204	0.1283
St. Mary's	-0.0042	0.0192
Talbot	-0.0890	0.1221
Washington	-0.0985	0.0188
Wicomico	-0.0448	0.1949
Worcester	-0.1399	0.2276

(Shading indicates factor is statistically significant at the 5% level or better. Positive values indicate that the factor increases the likelihood of receiving the preventive measure, relative to the reference group. A negative value indicates that compared to the reference group individuals with the indicated characteristic are less likely to receive the preventive measure.)

Figure 1: ***Prevalence of Diabetes Among Medicare Beneficiaries with Diabetes by County, 1997***

Figure 2: ***Use of HbA1c Among Medicare Beneficiaries with Diabetes by County, 1997***

Figure 3: ***Use of Eye Exam Among Medicare Beneficiaries with Diabetes by County, 1997***

Section IV: Conclusions and Recommendations

Diabetes mellitus is a highly prevalent condition; an estimated 14 percent of Medicare beneficiaries over the age of 65 residing in the state of Maryland received care for Type 1 or Type 2 diabetes. Diabetes, which accounts for a significant portion of national and personal health care spending, is accompanied by a significant and serious risk for morbidity and mortality. Importantly, with appropriate preventive care, including receipt of HbA1c testing and retinal eye exams to detect diabetic retinopathy, many of the complications associated with diabetes may be averted.

Comparison of State Rates of HbA1c and Eye Exams to Existing Benchmarks

Statewide, 59 percent of the elderly Medicare population who received care for diabetes also received testing for HbA1c levels and 44 percent were also tested for diabetic retinopathy. These rates correspond to the 50th percentile of the values obtained for these quality measures in the HCFA Diabetes National Project, conducted with 19 Peer Review Organizations[14].

The estimated rates for 1997 suggest substantial improvement in utilization of HbA1c from a 1990/1991 study that found only 22 percent of elderly Medicare beneficiaries in Maryland had received this test[15]. However, since 40 percent of elderly Medicare beneficiaries with diabetes did not receive an HbA1c test in 1997, there is much room for improvement.

The 1997 rates of utilization of eye exams indicate a slight decline from the 1990/1991 Maryland rate of 49 percent estimated in the same study. A recent study published in the *Journal of the American Medical Association (JAMA)* found that the cost-effectiveness of annual retinal screening of patients with Type 2 diabetes and without previously detected retinopathy is marginal compared to screening every second

or third year.[16] The authors of the *JAMA* article suggested that policies or guidelines indicating that all individuals with Type 2 diabetes should receive an annual eye exam be re-evaluated. If annual retinal screenings have only a marginal impact on the care rendered to low-risk patients with Type 2 diabetes, it is unclear whether the decline in eye exam rates represents an actual or a significant decline in the quality of care rendered to elderly Medicare patients with diabetes.

- **Recommendation #1.** The two measures that this project was based on, utilization of HbA1c and eye exams, are both *process* and not *outcome* measures of quality for patients with diabetes. Receipt of these clinical services suggests that care promoting glycemic control were rendered; however, they do not indicate whether appropriate glycemic control was achieved or whether complications of diabetes were averted. Utilization of HbA1c and eye exams is often used to measure quality of diabetes care because these measures are relatively simple to derive from administrative data sources (e.g., claims) and because national benchmarks are presently available. Yet, it is also important to determine whether clinical outcomes are appropriate and if care leads to improvements in health and functioning of people with diabetes. To this end, the National Committee for Quality Assurance has incorporated selected diabetes outcome measures, including measures pertaining to patients' level of HbA1c and lipid control, in their year 2000 HEDIS. Although development of these measures will require clinical data not contained in administrative records, we recommend that MHCC determine whether or not it is feasible to include selected diabetes outcome measures in their diabetes quality of care profiling system.

Receipt of Diabetes Clinical Preventive Measures and Patient Characteristics

The factors that account for the differences in utilization of the two diabetes clinical preventive services addressed in this project are difficult to identify, but appear to be related to both patient and provider characteristics. The most important patient characteristics included age and county of residence. The oldest group of patients, those over the age of 85, was significantly less likely than other age groups to receive either an

HbA1c or an eye exam. Rates of receipt of clinical preventive services for diabetes varied substantially across the state. Counties with high rates of utilization of HbA1c tests were not necessarily found to also have high rates of utilization of eye exams. For example, Garrett County in Western Maryland, which had the highest use of HbA1c tests in the state, also had among the lowest rate of diabetic eye exams. Worcester County, on the Eastern Shore, was found to have the highest rate of utilization of eye exams, but the third lowest rate of utilization of HbA1c. It was not possible to determine why rates of utilization of clinical preventive services varied by nearly 50 percent across counties. Differences in supply of primary and specialist physicians did not appear to be related to service utilization differences in the physician to population ratio. Indeed, the county poverty rate was found to be a more significant determinant of utilization rates; higher poverty rates were associated with lower utilization of HbA1c and eye exams.

- **Recommendation #2.** We recommend that MHCC collaborate with county public health departments and state medical associations to (1) explore the factors that account for county-level variation in utilization of HbA1c and eye exams; and (2) develop effective strategies to educate Maryland seniors with diabetes on the importance of working with their physicians to obtain appropriate diabetes care, including receipt of clinical preventive services. Although these strategies may be targeted towards all elderly residents with diabetes, some consideration should be given to the most appropriate strategies for reaching the oldest group of seniors (those over age 85) and those residing in counties with the lowest rates of utilization of HbA1c and eye exams. The findings of this project may be used benchmark the effectiveness of these efforts in promoting utilization of diabetes clinical preventive measures.

Provider Specialty and Rates of Receipt of Diabetes Clinical Preventive Services

The specialty and mix of physician specialties treating patients with diabetes appears to have a significant relationship to whether or not clinical preventive services were rendered. Utilization of both HbA1c and eye exams was highest among patients

treated by both primary and specialists physicians, than for patients who were exclusively treated by either primary or specialty physicians. The results of this project suggest that patients treated solely by a general practitioner were among the least likely to have received an HbA1c test, and that patients treated exclusively by either a general or family practitioner were among the least likely to receive an eye exam. Of particular importance, patients that incorporate an endocrinologist into their diabetes treatment dramatically improve their likelihood of receiving either of these two key clinical preventive services. In fact, in the case of eye exams to detect diabetic retinopathy, the likelihood of having received an exam is as high among patients with at least one visit to an endocrinologist as it is for patients with at least one visit to an ophthalmologist.

These results are not surprising, since several studies have found that diabetic patients treated by internal medicine specialists or family practitioners are more likely to receive these clinical preventive services than are diabetic patients treated by general practitioners.[15,17] A recent study further noted that diabetic patients treated by endocrinologists have significantly higher rates of utilization of these process measures than patients treated by either internal medicine specialists or primary care physicians.[17]

- **Recommendation #3.** Given the relationship between provider specialty and rates of receipt of diabetes clinical preventive services, we recommend that MHCC work with state medical associations, county public health offices and local or regional health systems to facilitate development of appropriate and innovative interdisciplinary team approaches for treating elderly patients with diabetes. An interdisciplinary treatment team approach to diabetes care, which, in addition to physician specialists may include nutritionists, dietitians, social workers, mental health specialists, and health educators, is supported by the American Association of Clinical Endocrinologists[5] as well as the American Diabetes Association.[18] Efforts to further an interdisciplinary treatment approach may require consideration of county differences in the availability of selected health professionals.

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